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TMS 2025

154th Annual Meeting & Exhibition

March 23–27, 2025
MGM Grand Las Vegas
Hotel & Casino
Las Vegas, Nevada, USA
#TMSAnnualMeeting

SUBMIT AN ABSTRACT FOR THE FOLLOWING TMS2025 SYMPOSIUM:

ADVANCED CHARACTERIZATION METHODS

Characterization of Materials through High Resolution Coherent Imaging

This symposium will highlight cutting-edge research in coherent and phase contrast imaging techniques, including x-ray and electron-based approaches like coherent diffraction imaging (CDI), ptychography, holography, and advanced phase contrast imaging (PCI) methods. We will explore their applications across diverse materials classes and delve into the integration of modeling, simulation, and artificial intelligence (AI) for enhanced characterization and analysis. The symposium will also bring in discussions on the new challenges in the era of diffraction limited storage rings (DLSR). We hope this symposium will help to foster collaboration and advance the field of coherent and phase contrast imaging. Background and Rationale: A high degree of spatial coherence is an attractive property in x-ray and electron beams. In some cases, these imaging methods provide resolution beyond that achieved with optics and can also provide remarkable sensitivity to a variety of contrast mechanisms. Various novel x-ray and electron coherent imaging methods have been developed and optimized, leading to rapid growth in applications over the past decades. It is expected that coherent imaging technical developments and applications will get a further boost in the era of DLSRs. More than a dozen DLSR facilities are currently operational or in the planning stage, providing unprecedented high-quality coherent x-ray sources. The two methods that will be the focus of this symposium are CDI and PCI with both x-rays and electrons. Both directly utilize the coherence properties of the incident beams. CDI has rapidly advanced in the last twenty years to allow characterization of a broad range of materials, including nanoparticles, strained crystals, micro-electronic chips, biomaterials and cells. PCI has been widely employed in dynamics and engineering studies of materials, geophysics, medicine and biology. These highly sensitive imaging techniques enable characterizing the structures of real materials under real conditions in real time. Advanced material modeling methods at the atomistic and continuum scales, including AI-based methods, are being used in conjunction with these imaging techniques to enhance their capability. The integration of AI, modeling, experiment not only makes reliable predictions at spatio-temporal scales in a broad range possible but also reduces the experimental measurement time, dose on the sample and amount of data. This is critical in the CDI and PCI applications in DLSR sources. On the one hand, the highly coherent X-ray sources based on DLSR would allow faster experiments at better precision and sensitivity in shorter time. On the other hand, the higher coherent flux may bring in more artifacts from surrounding materials other than the samples and enforce more severe radiation effects in the measurements. How to utilize these brilliant new sources wisely is a new challenge in the DLSR era. We will have a special session dedicated to the CDI/PCI developments and scientific applications from the new sources.

Areas of interest include, but are not limited to:

- All coherent and phase contrast X-ray-based techniques including Bragg CDI, Fresnel CDI, ptychographic CDI, propagation phase contrast imaging, interferometry imaging, and analyzer-based phase-contrast imaging.
- All electron-based techniques including ptychography and electron CDI.
- High performance computing (HPC) and AI to accelerate data analysis, improve image quality, imaging speed/efficiency, and autonomously steer experiments.
- Digital twins to inform high-resolution imaging experiments.
- All structural and functional materials systems needing high resolution imaging.
- Industrial applications
- Developments of new CDI/PCI experimental protocols.
- New sample preparation protocols.

ORGANIZERS

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SYMPOSIUM SPONSORS

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QUESTIONS?
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